

# METAL PIPE COUPLING AND ASSEMBLY

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This is a continuing application of USSN 60/456,579, filed 03/21/2003, entitled  
PLASTIC COUPLING FOR METAL PIPE.

## Background of the Invention

### 1. Field of the Invention

The present invention relates to couplings for joining pipe ends and in particular to  
couplings for metal pipes.

### 2. Description of the Related Art

As used here, the word "coupling" and the phrase "pipe coupling" refer to components for  
joining pipe or tube sections, especially sections of metal pipe or tube, typically for the  
purpose of forming an extended length of pipe. The requirements for such pipe couplings  
include a tight, preferably leak-proof seal between the adjoining pipe ends and corrosion  
protection for the bare metal of the pipe ends.

## Summary of the Invention

In one aspect, the present invention is embodied in components for joining pipe ends.

1 The present invention also is embodied in a coupling for joining pipe ends and in the  
2 resulting pipe joint and joined pipe sections.

3 In yet another aspect, the present invention is embodied in an assembly comprising pipe  
4 sections having ends joined by couplings in accordance with the present invention.

5 In another embodiment, the present invention is embodied in a composite, metal and plastic  
6 pipe assembly, comprising: first and second metal pipe sections having respective first and  
7 second ends; a first spigot cuff formed along the periphery of the first pipe end and a  
8 second bell cuff formed along the periphery of the second pipe end, the first and second  
9 cuffs forming a bell and spigot joint with the first, spigot cuff inserted into and joined to  
10 the second, bell cuff.

11 In yet another embodiment, the present invention is embodied in components for a  
12 composite metal and plastic pipe assembly, comprising: first and second pipe sections  
13 having respective first and second ends; a first spigot cuff formed along the periphery of  
14 the first pipe end and a second bell cuff formed along the periphery of the second pipe end,  
15 the sizes of the first and second cuffs being adapted for forming a bell and spigot joint  
16 when the first, spigot cuff is inserted into the second bell cuff.

## 17 **Brief Description of the Drawings**

18 The present invention is described with respect to the following drawings.

19 Figure 1 is a perspective view of a pipe assembly in accordance with an embodiment of the  
20 present invention.

21 Figure 2 is an exploded view of components of the pipe assembly of Figure 1, including the  
22 two pipe sections, prior to joinder using the coupling of Figure 1, and further depicts wire  
23 hoops and plastic cuffs that are components of the coupling.

Figure 3 depicts components of the coupling of Figures 1 and 2, in particular the wire hoops and bolts of the coupling.

Figure 4 depicts an end of one of the pipe sections that is cut away to effect a cross-section view showing the shape of the cuff and the mounting of the cuff on the pipe end.

Figure 5 depicts a cross section through the lips of the cuffs that are mounted on the pipe ends, and schematically shows the mating of the cuffs as the pipe of Figure 1 (also Figure 2) is being formed.

Figure 6 is a perspective view, in the manner of Figure 1, of a pipe assembly in accordance with another embodiment of the present invention, one using bolted wire rings or hoops.

Figure 7 depicts components of the coupling of Figure 6, in particular, the wire hoops and bolts of the coupling.

Figure 8 is a cross section representation of yet another embodiment of the present invention, a pipe assembly incorporating a bell and spigot coupling.

## Detailed Description

Figure 1 depicts a pipe assembly 10 comprising sections spiral corrugated pipes or pipe sections 11 and 12 which are joined by coupling 13, and Figure 2 depicts the pipe sections of Figure 1 prior to assembly. The illustrated pipe section 11 comprises spiral corrugations 14 and has a cuff 15 formed on end 16 thereof. The pipe section 12 comprises corrugations 14 and has cuff 18 formed on end 19 thereof. The invention is also applicable to smooth wall pipe.

The mating cuffs 15 and 18 have tongue and groove configurations, respectively. See Figure 5. Preferably, cuffs 15 and 18 are formed of plastic material such as polyethylene.

1 The cuffs 15, 18 are molded in place with formed tongue and groove. The pipe ends 16,  
2 19 are embedded in the molded plastic cuffs.

3 The couplings 13 include wire hoop assemblies 31 and 32 (also called wire wraps), which  
4 are depicted separately in Figure 3 and are shown mounted on the mating pipe sections 11  
5 and 12, respectively, in Figures 1 and 2. In the depicted embodiment, the couplings 13  
6 comprise cuffs 15 and 18 and hoop assemblies 31 and 32, although components of  
7 different size and/or shape can be used. As shown, hoop assemblies 31 and 32 can be  
8 identical or similar.

9 The illustrated hoop assemblies 31 and 32 comprise generally circular wire hoops 33  
10 having one or more (typically a plurality of) bolt-receiving peripheral loops 35-35 formed  
11 integrally with or joined to the associated hoop and lying generally in the plane of the  
12 associated hoop for receiving fasteners such as bolts 34. The illustrated bolts 34 are  
13 oriented approximately parallel to the longitudinal axis of the pipe and are used to tighten  
14 the pipe sections axially, parallel to the longitudinal axis, for compressing the cuffs and  
15 securely joining the pipe sections 11 and 12. See Figures 1 and 6.

16 The hoop assemblies 31 and 32 depicted in Figure 3 are welded, that is, the hoops 33 are  
17 formed with a gap and the ends of the hoop at the gap are joined together by a weld 38,  
18 typically after the hoops are mounted on the pipe ends 16 and 19. However, the hoops 33  
19 can be mounted on the pipe ends either before or after the cuffs 15 and 18 are applied, but  
20 are conveniently mounted on the pipe ends in the shop before the cuffs are applied and the  
21 ends are assembled. See Figure 2.

22 As shown in Figure 2, the cuffs 15 and 18 can be formed with shoulders or lips 39 against  
23 which the hoops 33 are seated. The shoulders permit the use of hoops of a size such that  
24 the hoops fit snugly on the pipes but are sufficiently loose to permit rotation for alignment  
25 with one another.

26 Figures 6 and 7 depict an alternative set of wire hoop assemblies 31, 32. Each of the  
27 hoops 33 illustrated in Figure 7 has a gap therein and a bolt loop 37 formed or attached at

1 each end of the hoop adjacent the gap. The loops 37 extend transverse to the plane of the  
2 associated hoop in the illustrated embodiment, preferably along planes approximately radial  
3 to the associated hoop so that a bolt 36 can be inserted through the loops for tightening  
4 the hoop against the pipe periphery to securely mount the hoop on the pipe. The bolts 36  
5 can be loosened to permit rotation of one or both hoops around the pipe to align the hoops  
6 and the loops 35 thereof for insertion and tightening of the bolts 34. See Figure 6.

7 In one suitable sequence for joining the pipe sections 11 and 12, prior to or after forming  
8 the cuffs, the hoop assemblies 31 and 32 are positioned on the ends 16 and 19 of the  
9 respective pipe sections 11 and 12 and are secured by means such as the welded joints  
10 38, Figures 1 and 3, or the bolts 36, Figures 6 and 7. The cuffs 15 and 18 are formed on  
11 the pipe ends 16 and 19 of the pipe sections 11 and 12. The alignment of the hoops 33 is  
12 adjusted as necessary (by simply rotating the welded version, or in the case of the bolted  
13 version, by loosening the nuts mounted on the ends of bolts 36 as required to permit  
14 rotation of one or both hoops, and then tightening the bolts as required) to align the loops  
15 35 of hoop assembly 31 with the loops 35 of hoop assembly 32. Bolts 34-34 are inserted  
16 through the aligned pairs of loops 35-35 and nuts are threaded onto the ends of each bolt  
17 and threaded further onto the bolt to tighten the pipe ends 16 and 19 against the cuffs 15  
18 and 18. This tightening of the bolts 34 securely joins the pipe sections together and  
19 compresses the cuffs 15 and 18 together and against the pipe ends to provide a positive,  
20 leak-proof, corrosion-resistant joint.

21 The couplings 13 are readily mounted on the pipe sections, readily aligned, and readily  
22 removed, and the alignment is readily adjusted. The process of coupling is accomplished  
23 using bolts, nuts and either welded wire rings/hoops or bolted wire rings/hoops, or  
24 equivalent simple hardware. In addition, despite the simple, inexpensive, easy-to-use  
25 structure and construction, the couplings provide secure, leak-proof joiner of the pipe  
26 sections.

27 In an alternative to loops which are formed integral with the wire hoops 33, the loops 35  
28 and/or 37 can be separate members which are bolted or welded to the hoops.

1 As described, for spiral corrugated metal pipe, the present invention is embodied in wire  
2 wraps using means such as welds or bolts to hold the wires on the pipe ends and bolts to  
3 pull and hold the two pipe ends together to form a positive joint with the cuffs.

4 As alluded to above, the present invention is also applicable to other types of pipes,  
5 including smooth wall pipes and the wire wraps can be placed on the pipes prior to placing  
6 other materials such as cuffs on the pipe ends.

7 As indicated above, the sealing gaskets or cuffs according to the present invention are  
8 molded onto smooth or corrugated pipe ends, and embed the bare, cut-off pipe ends in a  
9 protective cocoon of plastic which provides corrosion protection. Molded plastic can be  
10 formed by rotating the associated pipe end and laying on extruded plastic bead around the  
11 circumference of the pipe end. Then the excess material built up on the end can be folded  
12 over into the interior of the pipe. After set up, the resulting plastic "globbs" are machined  
13 to provide neater looking end(s). Care is taken not to place too much material into the  
14 interior diameter of the pipe, because excess material can impede and restrict flow within  
15 the pipe.

16 Preferably, to form the cuffs used here, inside and outside mold dies are used. Molten or  
17 semi-molten plastic is extruded to fill the void between the inside and outside dies, then  
18 under pressure the dies clamp and push the semi-molten extruded material into the cavities  
19 in the mold dies to create the tongue and groove profile or other selected profiles. The use  
20 of inside/outside dies under pressure moves the necessary plastic material to the outside of  
21 the pipe and a reduced amount of material to the inside diameter of the pipe sufficient to  
22 embed the pipe end and provide the necessary corrosion protection.

23 In one of the pipe forming techniques used by the assignee, three layer polyethylene is  
24 coated onto a metal strip, top and bottom, before the strip is formed into smooth wall or  
25 corrugated pipe. Such a plastic coated pipe is compatible with plastic welding and plastic  
26 welding to a variety of profiles and with a variety of cuffs and other plastic components of  
27 couplings.

1 One such profile is used in pipe 40, Figure 8. This figure depicts a bell and spigot coupling  
2 43 which joins corrugated pipe sections 41 and 42. The coupling 43 comprises a plastic  
3 cuff formed by spigot section 45 and bell section 48. The cuffs optionally and preferably  
4 include metal cores 51 and 52. The spigot and bell cuff sections 45 and 48 are formed on  
5 the corrugated pipe ends 41 and 42 as described above. The spigot section 45 and the  
6 bell section 48 are joined to their respective pipe ends by joints 53 and 54. Conveniently,  
7 when plastic coated pipes are used, as described above, these joints are plastic welds.  
8 Other types of joints can be used, such as bolts or rivets, but plastic welds are preferred.  
9 Also, wire hoops such as or similar to 31 and 32 can be used to augment the couplings 43  
10 and can be used in conjunction with cuffs having shoulders similar to the shoulders 39,  
11 Figure 2. The couplings 43 are applicable to a variety of pipes and pipe sizes.

12 Having thus described pipe couplings, pipe assemblies using the couplings and methods for  
13 forming and installing the couplings, all in accordance with the present invention, those of  
14 usual skill in the art will adapt the invention to other embodiments and derive other  
15 embodiments, limited solely by the claims appended hereto.